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Illinois Coal

Report of the Office of

# Coal Development and Marketing

# 1991 • 1992

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Report of the Office of

# Coal Development and Marketing

# 1991 • 1992

State of Illinois

Illinois Department of
Energy and
Natural Resources

Office of Coal
Development and
Marketing

Jim Edgar
Governor

John S. Moore
Director

# FORMATION AND RESPONSIBILITY OF THE ICDB

To better understand the world of Illinois coal, the Illinois Coal Development Board and the Office of Coal Development and Marketing has published this 1991-1992 Annual Report.

The 1990's are proving to be a crucial decade for Illinois coal. A decade of challenges to be sure, but also a decade of promise and opportunity. To Illinois, coal represents a great resource in terms of energy, security, domestic employment and export potential. To ensure Illinois coal's role as a reliable energy source in the future, Illinois has invested a great deal into advanced mining and combustion technologies. There are numerous possibilities lurking on the horizon for responsibly increasing the use of this valuable resource without compromising environmental quality. The unique characteristics of Illinois coal make it one of the nation's best fuels.

Despite the impacts of the Clean Air Act Amendments of 1990, I am confident that through ENR's Office of Coal Development and Marketing, clean coal technologies can continue to be advanced to meet the goals and needs of the state of Illinois.

Jim Edgar
Governor

Throughout the history of our state, coal has played a key role in shaping the people and it's economy. This report, prepared by the Illinois Department of Energy and Natural Resources, Office of Coal Development and Marketing, describes how Illinois has entered the 1990's challenged to maintain coal markets.

The Office of Coal Development and Marketing and the Illinois Coal Development Board have approached its tasks with persistence and enthusiasm. The Governor and the General Assembly can be proud of both the significant achievements already made and the groundwork that has been established for the future. The energy and economic benefits which Illinois can realize from its most valuable energy resource are clearly a powerful incentive for continued support of this program.

John S. Moore
Director
Illinois Department of
Energy and Natural Resources
Chair of Illinois Coal
Development Board

# INTRODUCTION

## The Office of Coal Development and Marketing
## Illinois Coal Development Board

Illinois' most abundant and economically important energy resource is high-sulfur coal. Extensive coal deposits underlying Illinois provide the economic foundation for communities in the southern and western regions of the state. However, with the passage of the Clean Air Act Amendments of 1990 (CAAA), the coal industry faces one of its greatest challenges ever. The CAAA requires utilities and other major consumers of Illinois coal to significantly reduce sulfur dioxides and nitrogen oxides. Utilities must implement compliance strategies based on the availability and implementation of new technologies for the mining, preparation and clean combustion of Illinois' coal resources.

Long before the 1990 revisions to the federal Clean Air Act, the state of Illinois was planning for the future. The Illinois Department of Energy and Natural Resources (ENR) is charged with developing and demonstrating the clean and economical use of Illinois coal through its Office of Coal Development and Marketing (OCDM). The research and development, technology demonstration and education programs of this office have received national recognition for their innovative and forward-looking approaches to high-sulfur coal utilization.

Since the creation of the Illinois Coal Development Board (ICDB) in 1981, it has played a pivotal role in advancing new technologies that enhance the use of Illinois coal. Empowered by the same legislative mandates that govern ENR's Office of Coal Development and Marketing, the board annually establishes research priorities. Since 1985, the board has exercised final approval authority over all research, demonstration and industrial coal utilization projects recommended by the ENR coal office.

A study by the Illinois Coal Development Board indicates that severe market losses will result from the Clean Air Act. In response to this report, the Illinois Delegation for Clean Coal, created by Governor Jim Edgar, has continued to encourage utility companies to build $SO_2$ scrubbers and continue to burn Illinois coal rather than switch to low-sulfur western coal to comply with the requirements of the 1990 Clean Air Act.

Coal is, after all, the future energy source: abundant enough to meet the world's energy needs for the next several decades, while also capable of protecting our environment. By using clean coal technologies, Illinois has successfully reduced sulfur dioxide emissions nearly 30 percent below 1970 levels. That early response made Illinois an environmental leader through clean coal technology (CCT) research and development.

Coal is a fuel for the 21st century, both by necessity and by technology. From the standpoint of necessity, coal is our most abundant fossil fuel resource, giving America literally hundreds of years of supply. From the standpoint of technology, the cleaning and burning of coal in a safe, efficient and cost-effective manner has made major strides and is being further refined every day.

In Illinois, these major strides in research are being coordinated by the ICDB and ENR. Their efforts are proof that the reality of coal today is that coal's bright past is but a prelude to coal's bright future.

### Illinois Coal Development Board Members

**Chair:**
**John S. Moore,** Director
Illinois Department of
Energy and Natural Resources

**Senator Ralph Dunn**
DuQuoin, IL

**Representative David Phelps**
Eldorado, IL

**Jan M. Grayson,** Director
Illinois Department of
Commerce and Community Affairs

**Ron Morse,** Director
Illinois Department of
Mines and Minerals

**Richard Brooks**
Freeman United Coal Company
Marion, IL

**Linda Denton**
Rend Lake Junior College
Ina, IL

**Carolyn J. Ehlert**
Deere & Company
Moline, IL

**Edgar Hale**
United Mine Workers of America
Pinckneyville, IL

**Richard E. Newtson**
A.G. Edwards & Sons
Springfield, IL

**Porter J. Womeldorff**
Illinois Power
Decatur, IL

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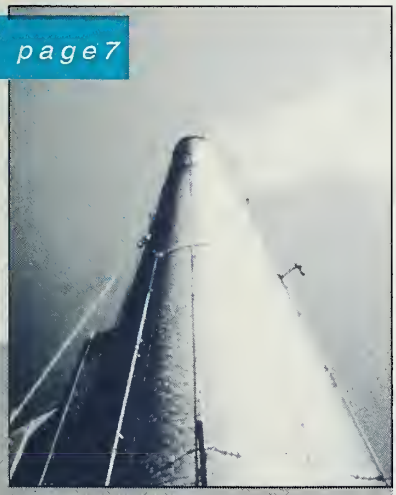

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# RESEARCH

Research priorities established by the Illinois Coal Development Board direct the nationally known Illinois Clean Coal Institute (ICCI) to administer state-sponsored research programs at various Illinois institutions. Successful results require researchers from both public and private sectors to collaborate and use the many capabilities offered at the Illinois Coal Development Park which houses the ICCI.

The basic and applied research sponsored by the Illinois Coal Development Board addresses: 1) ways to derive fuels and chemicals from coal, 2) combustion and gas cleanup technologies, 3) economic evaluations, 4) marketing analyses, 5) materials quantification, 6) waste management, 7) global climate change, 8) clean coal technologies, and 9) coal characterization. Additionally, several new program areas have been approved by the board for funding. Chlorine research represents an accelerated effort to determine the effects of chlorine in coal on combustion systems. Air toxins research will investigate the control of hazardous air pollutants.

Implementing the Clean Air Act provisions will require the utilization of such clean coal technologies as flue gas desulfurization and fluidized bed combustion. Utilization of CCTs will increase the need for research to fund environmentally acceptable ways to dispose of or utilize coal combustion residues. Anticipating this need, the Illinois Coal Development Board, through ENR's Office of Coal Development and Marketing, launched a cooperative industry/university/government program to do just that. The Coal Combustion Residue Management (CCRM) program is a highly focused, applied research program designed to address five important areas: 1) characterization of residues and by-products, 2) disposal technologies, 3) assessment of environmental impacts on surface and underground disposal and utilization of coal combustion residues, 4) utilization and by-product recovery from combustion residues, and 5) socioeconomic, policy and legal issues.

The Illinois Coal Development Board is also trying to satisfy the needs of the agricultural community through the cost-sharing effort of the Illinois Mine Subsidence Research Program (IMSRP).

The IMSRP is only one of a few such programs in the United States, and as such, has received national attention. The IMSRP is a collaboration among the agriculture and coal industries and scientists from all over Illinois. This research program focuses on mining methods that will benefit both industries by extracting maximum amounts of coal while simultaneously safeguarding land and water resources.

The IMSRP program is coordinated by the Illinois State Geological Survey, which includes work at the Survey, Northern Illinois University, Southern Illinois University and the University of Illinois. ▲

# ILLINOIS CLEAN COAL INSTITUTE

The Illinois Clean Coal Institute, formerly the Center for Research on Sulfur in Coal, was established in December 1982 to coordinate a comprehensive program to address the problem of sulfur and other noxious elements in Illinois coal. The name change reflects the need to broaden their research efforts to include all aspects of the 1990 Clean Air Act and specific issues inherent to the burning of Illinois Basin coals. The ICCI is under the purview of the Illinois Coal Development Board which is housed administratively in the Illinois Department of Energy and Natural Resources.

The search for the answers of how to burn Illinois coal, which is naturally high in sulfur, without releasing unacceptable levels of sulfur dioxide into the air, has been going on for decades.

That work is being done in the laboratories of major Illinois universities, in the demonstration projects being undertaken by the state's utilities and large industries, by researchers working for the state's coal companies, and through special programs being operated around the state.

Coordinating this massive effort is the Illinois Coal Development Board and the Illinois Department of Energy and Natural Resources, which administers the state's research, development and demonstration programs. The Illinois General Assembly established the Coal Technology Development Assistance Fund to allow the board and ENR to provide funding for laboratory research and development. To date, the board has approved nearly $20 million for laboratory research through the ICCI.

Currently, the research program consists of six major elements: cleaning, characterization, combustion, gaseous liquid and solid fuels and chemicals from coal, gas cleanup and related studies. Both solicited and unsolicited research proposals are submitted to the ICCI and are subjected to external peer review to ensure quality and relevance.

During the period 1982-1992, the ICDB contributed over $21.0 million to coal research in Illinois, with possibly another $2.0 million earmarked for 1993. Additionally, Illinois coal companies provided nearly $1 million between 1985 and 1991 to support basic and applied research. Emphasis is now being placed on cost-sharing with DOE and other organizations to leverage state funds to achieve the maximum possible efforts in creating new markets and continued utilization of Illinois Basin coals.

The ICCI program also maintains a Coal Sample Bank which currently contains eleven well-characterized Illinois Basin coals, eight from Illinois and three from Indiana. These serve as the resource for Illinois researchers in their efforts to understand, characterize and remove the sulfur from coal. Having common coals with which to work reduces acquisition and analytical costs, as well as provides a sample with known characteristics for various studies at different locations.

Information clearinghouse and technology transfer functions, including computer database access from remote locations, are also being implemented by the ICCI. Currently, significant quantities of chemical analyses on many Illinois coals are available, including those in the Coal Sample Bank. Short one-page descriptions of project results, called a Research Focus, are also available, along with quarterly and annual technical reports. An annual contractors' conference is held to provide a public forum for presentation of research findings. ▲

# DEVELOPMENT

The development program was initiated in 1990 to identify promising research projects and advance technology at the research level towards commercial demonstration. Thus, this program provides the link between the ongoing research and demonstration programs and provides a means of transferring technology from the research stage to demonstration.

The goals of the development program are to:

- Assist or encourage the development of clean coal technologies to maximize the competitiveness of Illinois coal in satisfying the substantial growth in electrical generating capacity expected to begin in the late 90's.
- Minimize the loss in existing utility markets for Illinois coal resulting from the Clean Air Act Amendments.
- Bridge the gap between bench-scale research and commercially scaled demonstration.

In order to establish priorities for the development program, an assessment was made based upon market, technology, and economic factors to determine the kinds of technology with the greatest potential to expand the market for Illinois coal.▲

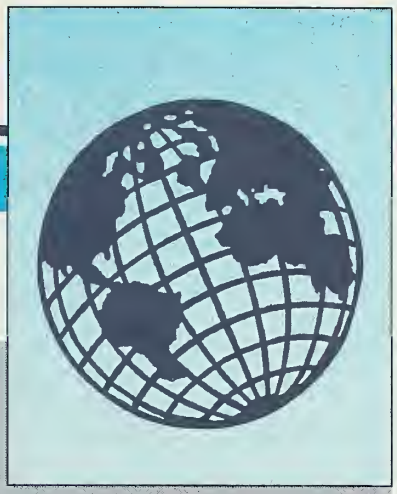
# DEMONSTRATION

The Illinois Clean Coal Technology Demonstration Program exemplifies a successful partnership between the public and private sectors in which the burden of technical and financial risk is shared. Potential demonstration projects must exhibit commercial readiness, economic feasibility, significant innovation and environmental acceptability before reaching this level. The investment of $157 million of state funds has resulted in additional investments of almost $661 million from other public and private sources.

What kinds of projects are being brought forth by this effort? Consider these:

- A second-generation flue gas desulfurization (scrubber) system, a more efficient and economical technology than conventional scrubbers. The system changes the polluting gases into saleable gypsum and is being demonstrated at the University of Illinois' Abbott Power Plant.
- Technologies that inject limestone during combustion to remove sulfur are called gas reburn-sorbent injection. This technology soon will be demonstrated at Springfield's City Water, Light and Power facility.
- Fluidized bed combustion technology, being demonstrated on an industrial scale, to burn coal with limestone in an upward current of air, providing simple, economic pollution control and removing nearly 90 percent of the sulfur dioxide gases. Several industrial plants, including Archer Daniels Midland Co. in Decatur and the B.F. Goodrich plant in Henry, have successfully demonstrated the technology.
- Aggregate flotation, a process that floats finely ground Illinois coal that has been chemically conditioned to stick to rising air bubbles, lets nearly all of the inorganic sulfur sink to the bottom of the mixing tank.
- Micronized coal has extremely small particle sizes which causes it to acquire unique combustion efficiencies and characteristics that are similar to oil firing and, when mixed with sorbents, can achieve reduced acid gas emissions. Likewise, its resulting ash has a potential by-product market which is not available to most other coal produced ashes. Rochelle Municipal Utilities is currently participating in a demonstraton of the Micronized Coal System process. ▲

# MARKETING



The overall objective of the Coal Marketing Program is to help Illinois industry penetrate new domestic and international markets for Illinois coal and coal-burning technology. One approach taken by the program "bundles" Illinois coal with demonstrated clean coal technologies. The key to expanding and maintaining markets is promoting the clean coal technologies which offer environmentally sound combustion techniques.

In its role as a facilitator of coal trade information, the Office of Coal Development and Marketing, in cooperation with the World Trade Center, formulated an international coal marketing initiative to expand the markets for Illinois coal. The Office of Coal Development and Marketing introduced the new service in the spring of 1992.

EXILLNET (Export Illinois Network) was designed in cooperation with the World Trade Center as an international coal marketing initiative to identify and penetrate overseas markets. EXILLNET is a comprehensive database program which contains international market profiles of potential buyers of Illinois coal, coal traders, global coal traffic and a detailed survey of coal-fired facilities overseas.

Illinois coal producers can take full advantage of potential overseas coal sales by implementing this international coal marketing program. The information compiled in EXILLNET will guarantee the Illinois coal industry the opportunity to maintain or increase the demand of its most abundant resource.

## Illinois Delegation for Clean Coal

Governor Jim Edgar formed the Illinois Delegation for Clean Coal in May 1991 to assist in maintaining the state's economy to sustain current Illinois mining levels of 60 million tons per year and to help preserve the livelihood of numerous, southern Illinois communities that rely on the Illinois coal industry.

Two-thirds of the coal mined in Illinois is sold to out-of-state utilities. With passage of the Clean Air Act Amendments of 1990, utilities nationwide are making decisions to formulate compliance plans for Phase I, effective January 1, 1995.

The preferred compliance option, from an Illinois perspective, is to assure the continued use of Illinois coal through the installation of clean coal technologies which remove sulfur in environmentally sound ways.

This option protects one of Illinois' largest industries, thousands of mining and other spin-off jobs, and provides long-term economical and environmental protection. In fact, utilization of a clean coal technology allows a utility to "over comply" with the CAAA, thus creating additional emission allowances and early compliance with the emissions standards of Phase II, which becomes effective January 1, 2000.

To achieve these objectives, the delegation provides out-of-state utilities currently using Illinois coal with economic and environmental verification that supports the use of clean coal technologies in conjunction with Illinois coal.

The delegation's primary function is to educate utility executives about the advantages of Illinois' compliance options, both economic and environmental, that utilities will experience by using Illinois coal and clean coal technologies.

The delegation began discussions with Illinois' largest coal purchaser, Union Electric, Missouri. In addition, the delegation visited Indiana, Georgia, Wisconsin and Florida in efforts to promote the continued use of Illinois coal. Long-term, the delegation hopes to not only secure the present level of coal production in Illinois, but to increase coal sales by expanding the existing market.

Declines in costs of delivered western coal to these utilities has made the task of the delegation and Illinois coal producers much more difficult. The delegation continues to promote the advantages of Illinois coal and clean coal technologies, such as:

- Scrubbing reduces the emissions of sulfur dioxide ($SO_2$) by 90 to 95 percent. This technique offers the greatest reduction of $SO_2$ emissions available to date.
- Scrubbing achieves a greater reduction in emissions than does fuel switching to western coal.
- Burning unscrubbed western coal produces emissions at a rate of approximately 1.0 - 1.2 lbs. of $SO_2$ for every million Btus of fuel input. Burning scrubbed Illinois coal could reduce those emissions to roughly 0.3 - 0.6 lbs. of $SO_2$/million Btus.
- Bituminous coal found in Illinois burns more efficiently (hotter) than coal found in western states. Therefore, more western coal is needed per Kw than Illinois coal per Kw.
- Scrubbing generates excess allowances that can be banked, sold or leased to reduce the utilities' cost of emission controls and to allow for future growth.

## Midwestern/Eastern Coal States Coalition

As the governor's delegation began to gain momentum and held several meetings with out-of-state utilities, it became apparent there was little coordination among coal states, especially in areas of federal energy and coal-related policies.

Based on interest expressed toward the issues at hand, the following states were invited to be members of the coalition: Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Virginia, New York and West Virginia.

Efforts should be undertaken to communicate the importance of coal targeted to the general public, education system, state government leaders, federal legislators, utilities and coal producers. The awareness program will work to dispel myths regarding coal by disseminating sound, scientific information and highlighting current issues that support coal use.

For example, the Coal States Coalition is dedicated to ensuring that coal continues to play a significant role in the nation's energy mix and receives adequate attention in the National Energy Strategy. The coalition also will be dedicated to the application of new and proven clean coal technologies that will provide cleaner generation of energy using high-sulfur coal and address global climate change and toxic air emissions.

The coalition will respond to the challenges of the 1990 amendments to the Clean Air Act, as well as prepare for future environmental legislation, with clean coal technologies. The coalition will work to shape federal policy and future legislation, technologies and emission credits.

The coalition will also serve to present a united front for the utilization of coal and clean coal technologies to further the common interests of coal producers, utilities, industrial users and ratepayers. To that end, coalition members have the following objectives:

- Work together for a stronger pro-coal voice at the national level.
- Maximize intellectual, technological and creative resources.
- Influence legislation and sound environmental issues.
- Protect and promote safe, abundant and efficient energy for the future.
- Intervene to protect existing coal markets and target and implement strategies for new markets.
- Coordinate approaches to the emission allowance market. ▲

# EDUCATION

Significant progress has been made in the last two years toward educating the general public about the importance of coal in Illinois and about the benefits of clean coal technologies.

A comprehensive Coal Awareness Program informs public and private policymakers of environmentally sound technologies which can mitigate the effects of the 1990 Clean Air Act Amendments. The ICDB's action to provide funding for a program to educate the public about modern coal use is an indication of the commitment to which the state of Illinois has pledged itself in its continuing support of coal. This action sends a message not only to the utility and industrial sectors of the business community, but to all sectors of society, that coal and compatible clean burning technologies can realize full commercialization. The nation's energy requirements can be satisfied without sacrificing the quality of our environment.

## Kids, Coal and the Environment

Complimenting efforts to reach the general public, a new component of the Coal Awareness Program, was initiated in 1992. An educational program geared toward fifth- and sixth-graders is being developed for teachers to utilize as a supplement to their textbooks and standard curricula. Tools to be developed under this initiative include a resource kit — complete with lesson plans on coal mining, extraction, reclamation, uses, transportation, and clean coal technologies. The lesson plans will be supplemented with a children's video and teaching aids such as overheads, slides, games, experiments, quizzes, and suggestions for field trips. The video, "Kids, Coal – and the Environment," won top honors in the QUESTSTAR international video competition award. A children's newsletter, *Kids, Coal & Energy*, was also created as an educational tool.

Providing teachers with sound scientific energy information is fundamental to influencing public perceptions about coal today. Celebration of Coal Awareness Week (October) and Clean Air Week (May) are major events sponsored by OCDM. Teachers and their classes are invited to participate and attend specially planned activities. New educational materials will be introduced each year in conjunction with Coal Awareness Week to encourage teachers to share the information with their classes and promote the environmentally sound uses of coal.

## Words and Pictures About Illinois Coal

Another aspect of the Coal Awareness Program is the "Words and Pictures About Illinois Coal" competition. This fun and educational contest was designed for fifth- and sixth-grade students to highlight the heritage and importance of Illinois coal. Since it's 1989 inception, participation has nearly tripled, reflecting the overwhelming success of this program which promotes a positive coal image through education.

The statewide art and essay contest about coal encourages the students' imagination and creativity while they compete for prizes. Thirteen young artists and twelve budding authors are awarded $50 savings bonds for their winning entries. The successful entrants also receive certificates from the Governor of Illinois and other dignitaries, congratulating them on their accomplishments.

The lesson best learned was well summarized by Matt Link of Carlinville whose winning essay concluded with the words: "Americans make use of coal often and they do not realize it. This great rock makes our lives easier." The essays would surprise casual readers with the tremendous information and insight that the writers have about coal.

This educational campaign results in the annual publication of a calendar showcasing both the art and essay winners' entries. The contest is co-sponsored by the Coal Research Center at Southern Illinois University. The annual contest is held each spring. ▲

# PROJECT FUNDING FROM THE ICCTD PROGRAM

The following is a list of projects receiving financial support through the Illinois Clean Coal Technology Demonstration Program. Also provided is Total Estimated Project Cost and State Contribution.

PROJECT
TOTAL COST *(T COST)*
STATE COMMITMENT *(S COM)*

1. Combustion Engineering
   Atmosphoric Fluidized Bed Combustion
   $20,219,000 *(T COST)*
   $750,000 *(S COM)*

2. Allis Chalmers KILnGAS
   Coal Gasification Combined Cycle
   $219,900,000 *(T COST)*
   $35,850,000 *(S COM)*

3. B.F. Goodrich
   Circulating Fluidized Bed Combustion
   $19,300,000 *(T COST)*
   $4,300,000 *(S COM)*

4. Midwest Grain Products
   Fluidized Bed Combustion Cogeneration
   $12,266,000 *(T COST)*
   $2,500,000 *(S COM)*

5. Archer Daniels Midland
   Circulating Fluidized Bed Combustion/Cogeneration
   $100,000,000 *(T COST)*
   $6,000,000 *(S COM)*

6. Abbott Power Plant University of Illinois
   Chiyoda CT-121 Flue Gas Desulfurization
   $21,900,000 *(T COST)*
   $21,900,000 *(S COM)*

7. Anderson Clayton Foods
   Wormser Duel Fluidized Bed Combustion
   $5,179,000 *(T COST)*
   $900,000 *(S COM)*

8. UOP, Inc.
   Copper Oxide Proof of Concept, CECO
   $1,989,000 *(T COST)*
   $84,000 *(S COM)*

9. EERC
   Gas Reburning/Sorbent Injection (2 Sites)
   $30,000,000 *(T COST)*
   $5,000,000 *(S COM)*

10. Radian Corp.
    Sorbent Duct Injection
    $4,300,000 *(T COST)*
    $600,000 *(S COM)*

11. TransAlta Resources
    Low NOx/SOx Burner
    $13,576,000 *(T COST)*
    $3,000,000 *(S COM)*

12. AFT, Inc.
    Advanced Coal Cleaning Dem.
    $9,200,000 *(T COST)*
    $2,000,000 *(S COM)*

13. Combustion Engineering
    Integrated Gasification Combined Cycle
    $270,700,000 *(T COST)*
    $32,000,000 *(S COM)*

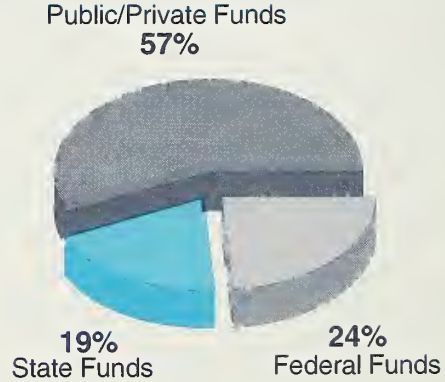
14. RAM, Inc.
    Pircon-Peck Process
    $8,400,000 *(T COST)*
    $4,200,000 *(S COM)*

15. Tecogen, Inc.
    IRIS Combustor Dem.
    $2,600,000 *(T COST)*
    $500,000 *(S COM)*

16. IGT Kerr McGee
    Mild Gasification and Co-products Dem.
    $17,964,000 *(T COST)*
    $3,385,000 *(S COM)*

17. Rochelle Municipal Utilities
    TCS Micronized Coal System
    $18,000,000 *(T COST)*
    $3,600,000 *(S COM)*

## Source of Funding for Illinois Clean Coal Demonstration Projects



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